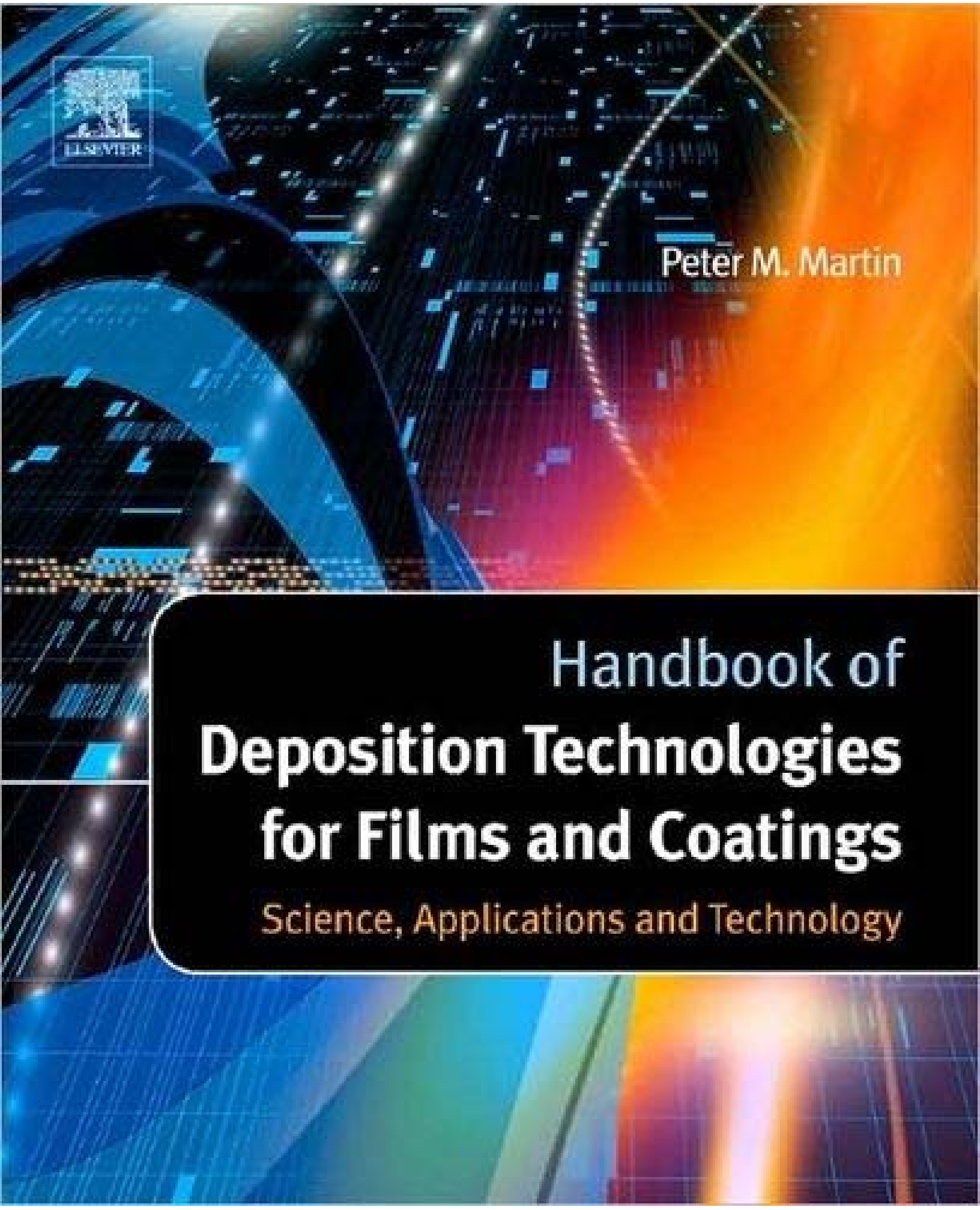
ELSEVIER
Peter M. Martin
Handbook of
Deposition Technologies
for Films and Coatings
Science, Applications and Technology

CHAPTER 2

Plasmas in Deposition Processes

Scott G. Walton and J.E. Greene

2.1	Introduction	33
2.2	Particle Collisions, Energy, and Motion	34
	2.2.1 Collisions: Mean Free Path and Cross-Section	34
	2.2.2 Electron Kinetic Energy	37
	2.2.3 Electron Energy Distribution	38
	2.2.4 Collision Frequencies	40
	2.2.5 Reaction Rates	42
	2.2.6 Mobilities	43
	2.2.7 Conductivity and Diffusion	44
	2.2.8 Particle Motion in Magnetic Fields	45
2.3	Plasma Parameters and Collective Behavior	47
	2.3.1 Plasma Sheaths	48
	2.3.2 Ambipolar Diffusion	53
	2.3.3 Plasma Oscillations	54
2.4	Discharge Plasmas	55
	2.4.1 Introduction	55
	2.4.2 Plasma Production and Breakdown	58
	2.4.3 Cold Cathode Discharges	60
	2.4.4 Magnetron Discharges	62
	2.4.5 RF Discharges	63
2.5	Gas-Phase Plasma Reactions	66
	2.5.1 Introduction	66
	2.5.2 Electron–Atom Interactions	67
	2.5.3 Electron–Molecule Interactions	68
	2.5.4 Metastable Species and Processes	70
	2.5.5 Applications of Volume Reactions	71
2.6	Plasma–Surface Interactions	73
	2.6.1 Introduction	73
	2.6.2 Ion Bombardment	73
	2.6.3 Electron Bombardment	80
	2.6.4 Photon Interactions	81
	2.6.5 Summary of Surface Reactions	82
2.7	An Example: Magnetron Discharge for Deposition	83
2.8	Summary	86

Copyright © 2010 Peter M. Martin. Published by Elsevier Inc.
All rights reserved.